STATE OF ILLINOIS

HENRY HORNER, Governor

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VOLUME 30 SEPTEMBER, 1937 NUMBER 1

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Memoirs

Index of Volume 29

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LIST OF SPEAKERS

A committee designated by the Council of the Academy has prepared a list of speakers who are willing to present talks on various phases of science before interested groups. Unless otherwise indicated, these speakers are willing to give their services for expenses only. In some cases a small honorarium is expected. A copy of this list of speakers may be obtained gratis by sending a request to:

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Evolution of Sex in the Mollusca*

Clarence Lee Furrow, Ph. D.
Knox College, Galesburg, Illinois

IT IS the purpose of this paper to present some of the trends in the more general problem of evolution of sex in certain of the molluscan groups. The author is especially interested in the problems which arise by the interactions which occur when the male and female germ cells take origin and reach their maturity in the same gland, the hermaphrodite gland, or ovotestis, as it is sometimes called. While most of my work has been centered on the gastropods, especially the fresh-water snails where most unusual variations in structure and behavior have been observed, other groups offer many unusual conditions of sexuality. These variations take such trends as deviation in development, structural differences in arrangement of male and female germinal tissues, alternation of male phase with female phase in sexual cycles, the presence of the capacity for self-fertilization in some forms, the absence of this function in others, the production of abortive eggs, parthenogenesis and the occurrence of spermic dimorphism.

The existence of animals producing both male and female germ cells in a single gland has been known since the early Greeks. These hermaphrodite snails attracted the attention of Aristotle when he observed that members of the group, Testacea, which included the gastropod molluscs, reproduced like plants. In accordance with other Aristotelian explanations it is to be concluded that the young gastropods spring from the mud and slime of the ponds, lakes and rivers. This concept appears to have existed unchallenged until late in the sixteenth century when Androvandi[1] stated that snails reproduce by sexual methods (Baudelot, 1863). The renowned French naturalist, Cuvier (1846), working in the early nineteenth century failed to recognize the dual nature of the ovotestis and concluded that both *Planorbis* and *Lymnaea,* common pond snails, have separate sexes. Both of these forms are hermaphroditic, i.e., they are monoecious or unisexual.

*Abstract of address of the Retiring President. Presented before the General Session at the Thirtieth Annual meeting of the Illinois Academy of Science, May 7, 1937. Contributed from the Biological Laboratory of Knox College and the Zoological Laboratories of the University of Iowa, aided by a grant from the National Research Council, through the Committee for Research in Problems of Sex; grant administered by Dr. Emil Witschi.

A study which has held the attention of many workers in biology is that of Carl von Siebold (1837) published a century ago in which the existence of spermic dimorphism was established. Basing his conclusions on observations on the history of the germ cells of *Paludina vivipara (Vivipara vivipara)* von Siebold showed that two very different kinds of sperm cells are produced in the gonad of this snail. This observer did not suggest the probable significance of these most unusual conditions, and after one hundred years their function is still a matter of uncertain speculation. This early work on the snail *Paludina,* has led to many classical studies in the fields of embryology and cytology of the gastropods.

The functional significance of these aberrant germ cells is a controversial subject of long standing. While some authors (Brock 1881; Lams 1909; Kuschakewitch 1911; and Gatenby 1917) consider them as abnormalities of development or products of degeneration. Others (R. Hertwig 1905; Reinke 1914; Hyman 1925; Furrow 1935) are impressed with their persistent character and complicated courses of development of some types and conclude that they must have some, at present unknown, physiological significance.[1]

Studies on the development of the fresh-water snails has offered much of interest to the student of morphology and experimental embryology. Growing out of this interest have come many concepts bearing on anatomy, taxonomic relations and physiology. In the field of anatomy the relation of the snail having unisexual characteristics or hermaphroditism, to those possessing bisexual or separate sexes continues to offer a fertile field for study.

It is clear from the results of investigations already at hand that in the hermaphrodite snails the male and female genital elements have a common origin, a condition of monoecism is set up which we may designate as **unisexual.** In such cases of unisexual monoecism a female or (male) animal develops at certain times spermatozoa in the ovary (or eggs in the testis). In consequence of this relationship of germinal elements one or the other sex becomes superfluous and more or less disappears. Special biological conditions accompany these phenomena. Under the classification of unisexual monoecism two generalized genital patterns exist in these hermaphrodite snails.

Using the structural relations of the male and female germinal elements as a basis of separation one may define one of these genital patterns as unsegregated. In this type the sex cells are not anatomically or histologically separated or restricted to a male zone or female zone in the ovotestis. The second pattern may be called segregated, because of the strict separation of the male germ cells from the female germ cells in the hermaphrodite gland.

The ovotestis of the unsegregated type is composed of a series of compartments or cysts which give the gonad the appearance of a compound acinus gland. The cysts containing both the male and female

cells join a common outlet, the hermaphrodite duct which serves as both a sperma duct and an oviduct. This condition of sexuality exists in *Helix, Physa, Lymnaea, Planorbis,* and *Polygyra.*

While these forms are true hermaphrodites their reproductive cycles appear to be quite definitely divided functionally into a male phase during which the animal discharges spermatozoa, and later, into a female phase during which eggs are deposited. Referring to the structure of the ovotestis of these forms, while the male and female tissues are not anatomically segregated, the developmental processes of the male germ cells are separated from the female germ cells by a functional factor, a time interval. The duration of this time interval appears to vary considerably, and at times under certain experimental conditions, it may be shortened almost to the extent of complete elimination.

Some evidence has been obtained to show the probable significance of this fluctuation in the extent of this time interval which occurs between the male phase and the female phase. If individuals of *Planorbis* are reared in mass cultures reproduction occurs regularly by cross fertilization. If however, individuals are segregated at the time of hatching and permitted to live in strict isolation the snails in such cultures will upon reaching sexual maturity reproduce by using the method of self-fertilization. In the latter case the time factor (or interval) which separated the normal functional phases has become reduced to such an extent as to allow the eggs to reach maturity about the same time that the sperm cells complete their course of development. In another pond snail, *Lymnaea,* similar conditions exist. Colton (1921) preventing cross breeding by isolation for forty-seven generations found that only temporary alteration in the sexual cycle occurs. The nature and cause of these changes in sexual cycles in Planorbis and Lymnaea are not definitely known.

In a marine gastropod, *Crepidula plana,* an unusual condition of sexuality exists. *Crepidula* is hermaphroditic, but completely protandric, i.e., the male and female phases are completely separated in time. The male phase develops first. This phase is then normally followed by a period of transition in which the animal exhibits characteristics of both sexes, a condition of hermaphroditism. Toward the close of the life-span the animal becomes completely transformed into a female. Under experimental conditions if the male is removed from the vicinity of the larger individual the male genital organs degenerate, and after a brief period of sexual activity the animal becomes female. The nature of the stimulus exerted by the larger individual has not been ascertained.

The fresh-water prosobranchiate gastropod, *Valvata tricarinata* (fig. 1), illustrates the second or segregated type of sex differentiation. Here a sex condition exists in which the animal is definitely a Protandric Hermaphrodite. The snail is first male in function and after a brief transformation period or sex reversal the animal takes on the function of a female.

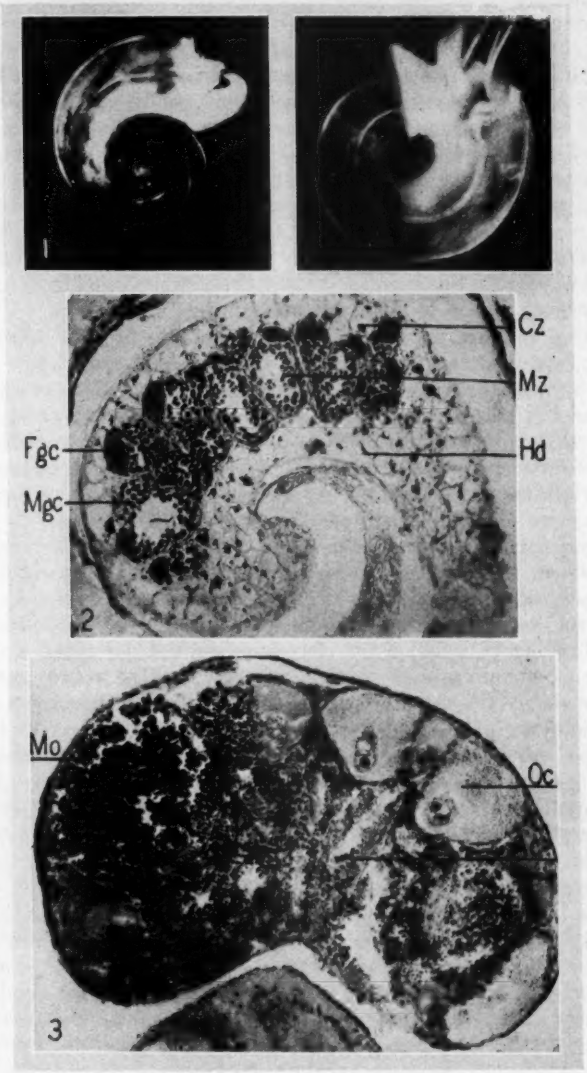

Fig. 1.—A young Valvata at the beginning of the first sexual cycle. Age 135 days. (X 17).

Fig. 2.—Photomicrograph of a longitudinal section of the ovotestis of a young individual. The segregation of the male and female zones is shown.

Unlike Crepidula the development of the female phase is in a manner contingent upon the influence of older individuals. The young Valvatas develop normally whether they are reared in mass cultures or in strict isolation. In Valvata, as in Planorbis, the male and female germ cells differentiate early in development of the animals and follow independent courses. In Valvata, however, the male tissues are completely separated, anatomically, from the female elements (fig. 2), representing a condition of gonad structure which does not exist in the other forms already mentioned.

This separation of germinal elements is accomplished early in embryonic development by the segregation of the germ cells into the female zone which occupies the cortex of the gonad, and by a similar segregation of the male germ cells into the acini which compose the medullary or central region of the ovotestis. This arrangement of embryonic male and female tissues which has been reported recently in two classes of mollusca, certain snails, and the eastern oyster, is also found in certain vertebrates, particularly some amphibians. The latter forms include an indifferent or hermaphrodite stage in their gonadal differentiation.

This phenomena of segregation of reproductive tissues in snails is of further interest because of the relation of the structural condition to the functional behavior of these male and female tissues. In some forms, the protandric hermaphrodites, this relationship determines the order of sexuality, i.e., the animal is first male because of the position of the male germ cells with respect to the hermaphrodite duct. Following the discharge of the spermatozoa, a brief transition period follows during which complete reversal occurs, and the snail assumes female characteristics. The female germ cells (fig. 3) migrate from the cortical region through the medullary zone to reach the hermaphrodite duct. Since both sex cells utilize the hermaphrodite duct the question of self-fertilization arises.

The functional stability of the separation of these two tissues in Valvata has been tested repeatedly by attempts at self-fertilization. Over sixty animals have been reared in strict isolation by segregating the young as they emerge from the egg-capsules. These segregated snails did not reproduce. This fact is construed as further evidence

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Fig. 3.—A photomicrograph of a cross-section of the ovotestis at the beginning of the male phase.

LEGEND

Cz—cortical zone (female)
Mz—medullary zone (male)
Hd—hermaphrodite duct
Fgc—female germ cells
Mgc—male germ cells
Mo—mature egg cell
Oc—young ovocyte
Ac—acinus containing mature spermatozoa and developing spermatocytes

supporting the idea of stability of separation of the germinal elements in this form, a condition which is in harmony with the independence of the transition phase (time factor). The alternation of the sexual phases (fig. 4) continues throughout the life span of *Valvata tricarinata.* While these male and female elements are separated, their activity in the hermaphrodite gland is productive of other complications which alter the course of development of some of the germ cells, both male and female.

These deviations take the forms of abnormal development in the maturation of the male germ cells, a course which ends in the production of atypical spermatozoa. These cells vary in development, cytological structure, and behavior from the typical or normal male germ cells. In studies on two European species of fresh-water snails, *Valvata piscinalis,* and *Valvata cristata,* another complication to the problem has been added. *Valvata piscinalis,* the Bavarian species, has a perfectly normal spermatogenesis and consequently does not produce abnormal spermatozoa. The Italian form, *Valvata cristata,* on the other hand, shows a strong tendency toward abnormality and produces regularly both normal and atypical spermatozoa. The American species, *Valvata tricarinata,* shows even stronger tendencies toward increasing abnormality by producing four types, one normal type and three atypical sperm forms. On the basis of origin the atypical cells may be classified as variations of one general type, thus maintaining strict spermic dimorphism. A fourth species, *Valvata japonica,* has been examined and the existence of atypical spermatogenesis noted, but information necessary to complete the classification of this form is at present lacking.

These fresh-water snails present an interesting series with respect to the degree of development of this increasing abnormality and may be placed in order on the basis of the degree of deviation from the normal condition. *Valvata piscinalis* would be placed first, *Valvata cristata,* second, and *Valvata tricarinata* third. The position of the Japanese species in this series is at present undetermined.

These complications in the germ cell cycle of these animals have been made even more significant by the recent discovery of the existence of a case (Artom 1933) of abortive ovogenesis or atypical development of the female germ cells in *Valvata piscinalis.* Here cells which appear in the male germinal epithelium assume the characteristics of the female germ cells. Continued growth and differentiation of these cells results in the production of egg-like cells which may be designated as pseudo-ova. There is further interest in this phase of the problem because of the apparent, at least in this case, parallel evolution of this abnormal tendency in both the male and female lines of germ plasm in this group.

While this problem takes the form of almost uncompromising controversy some particularly definite trends should be pointed out.

(1) From both physiological and morphological evidence some investigations show that atypical spermatozoa are rudimentary eggs.

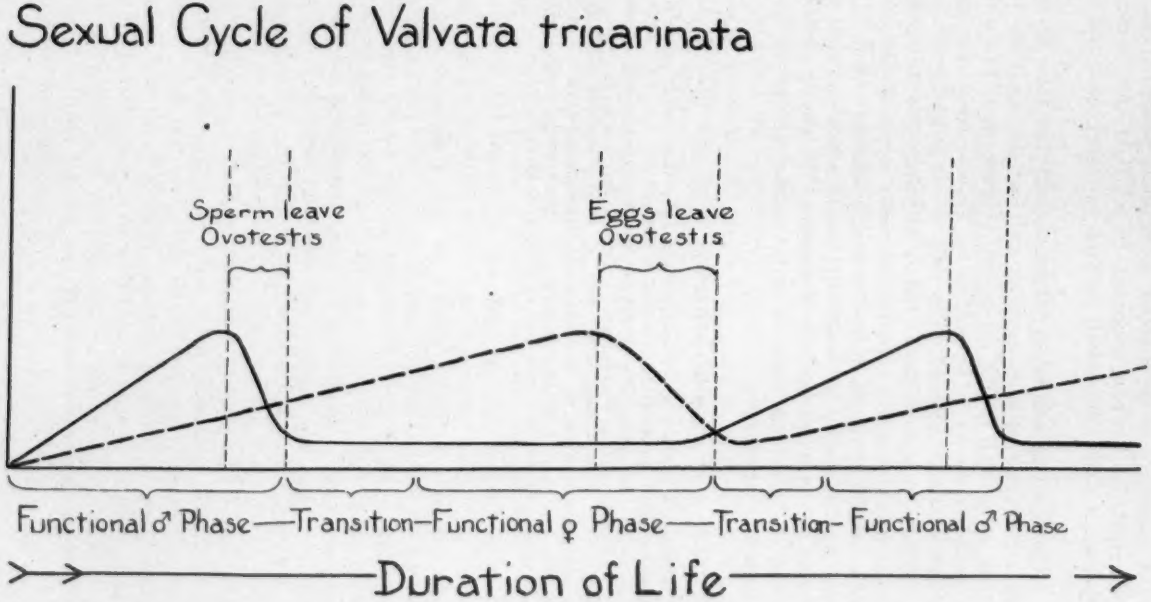
Sexual Cycle of Valvata tricarinata
Sperm leave Ovotestis
Eggs leave Ovotestis
Functional ♂ Phase—Transition—Functional ♀ Phase—Transition—Functional ♂ Phase
Duration of Life

Fig. 4.—A diagram to illustrate the phase history of the hermaphrodite gland during the male and female stages of the sexual cycle of *Valvata tricarinata*.

(2) A possibility of the atypical spermatozoa possessing the capacity for fertilization has been suggested. In this light such conditions would represent a stage intermediate between parthenogenesis and true fertilization.

(3) The more recent investigations suggest that these atypical germ cells are entirely without function, and that this abnormal condition arises as a result of the interaction between these two widely differing germinal tissues. The studies on *Valvata tricarinata* show that the fate of these abnormal germ cells is complete degeneration.

(4) Finally, it is clear that in certain hermaphrodite snails where the male and female elements appear functionally separated, the sexual cycle may be altered by forced changes in sexual behavior. And, it has been shown that in certain hermaphrodite snails, where the male and female tissues are separated not only in function, but also in structural arrangement, the functional cycle is in no manner altered by forced changes in sexual behavior.

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The 1937 Flood in Southern Illinois

Don L. Carroll

Illinois State Geological Survey, Urbana, Illinois

The great flood which swept down the Ohio Valley during late January and early February, 1937, brought home to the entire nation a realization of the value of engineering data applicable to the situation. This paper stresses in particular the demonstrated usefulness of topographic maps which were available, covering the entire area of southern Illinois that was involved in the disaster. The need for a detailed map of the Illinois flood area was apparent as soon as it became evident that the water would reach an unprecedented height. It was likewise apparent that such a map could be prepared most quickly and accurately by the use of standard quadrangle topographic maps as a base for plotting the extent of the inundation throughout the region. Fortunately, all the necessary maps were at hand, having been prepared over a period of some thirty years as a cooperative project of the Illinois State Geological Survey and the U. S. Geological Survey. Representing three-dimensional portrayal of land relief and the works of man, these maps supplied, on a scale of one inch to the mile, a perfect base on which to plot the flood coverage. Measurements and observations made at selected points, together with logical interpolations of the situation at other points, gave the data needed for superimposing on the topographic base an almost photographic reproduction of the flooded region. The composite map totalled eight by six feet in size.

Data shown on the map.—The map shows not only the extent of the flood in southern Illinois, but also the depths of the water throughout the flooded areas. Furthermore, it shows the mileages of flooded roads and railroads, the location and configuration of high points isolated by the flood, and most of the houses and other buildings invaded by the water.

Reference to the map shows that at least 1200 square miles of land in Illinois alone were covered by the flood waters. This land represents, for the most part, the most fertile farming areas of that part of the State. The losses in stock, equipment, buildings and furnishings can hardly be calculated. In addition, at least 43 cities and towns were directly involved in the disaster in the same area. More than 125 miles of railroad right-of-way was also under water before the crest of the flood was reached.

Several mines in the famous Harrisburg coal mining region were flooded, either through the shafts or by percolation through their roofs. Flooding of any coal mine is a serious matter, often necessitating its abandonment; and it is feared that some of these mines may never be reopened. The locations of most of these mines are shown on the map.

The full size map is on display in the offices of the State Geological Survey in Urbana, and is available for examination by any one interested in securing data that may be shown on it.

Procedure.—The original map of the flood was made for reference use at Illinois National Guard Flood Headquarters at Eldorado. It was plotted from data secured at various points along and within the margins of the flooded area, observation trips being made by automobile, boat and airplane. So far as possible, the mapping was done by noting the relation of the flood to points of known elevation. In other cases the water line was sketched with reference to topographic features, houses, known mileage of flooded roads, et cetera. It was also necessary, in order to prepare a working map as soon as possible, to interpolate the elevation of the flood stage between points of known elevation. In spite of the necessity for haste, in quickly preparing a map for emergency use, later checking of the map proved the soundness of the methods employed in its preparation.

Following the completion of the field map for headquarters use, similar maps were made in the offices of the State Geological Survey, at Urbana, for use in the offices of Governor Horner, at Springfield, and for permanent reference use in the Geological Survey technical files. With more time and better facilities available for the preparation of these latter copies, more care was taken in their drafting.

Causes of the flood.—Examination of the flood map reveals many surprising facts—facts that at first glance may appear to be founded on faulty observations. With this situation in mind it seems advisable to include in this report a summary presentation of the factors involved in causing the flood, as it was expressed in the lowland areas of southern Illinois. With these factors outlined in proper relation to each other, seemingly unbelievable situations in regard to the flood become understandable.

Abnormal rainfall.—Over a large area drained by the lower reaches of the Ohio a moderately heavy snowfall took place during the period immediately preceding that of the flood. Followed by warmer weather with rain and thawing, great quantities of water were dumped into numerous tributary streams which normally disgorge into the Ohio without difficulty, but which on this occasion found their outlets blocked by high water in the major valley.

For the most part, however, the flood in the Ohio Valley proper resulted from the unchecked runoff of a record rainfall over a much greater area, including all or considerable portions of Illinois, Indiana, Ohio, Pennsylvania, West Virginia, Kentucky and Tennessee. In these

states the ground was already well saturated with water as a result of the unseasonable and frequent rains of December. When, during the last three weeks of January, the entire region was again subjected to still heavier rainfall, the situation became serious. The already saturated soil could not retain this new supply of water. Furthermore, prevailing temperatures, far above the freezing point, allowed the runoff to take place unchecked. Figures secured from the U. S. Weather Bureau show that throughout the region in question from two up to more than sixteen inches of rainfall were recorded in the period from January 6 to January 26. More significant still is the fact that the heaviest precipitation was recorded in the areas immediately adjacent to the Ohio River, on both sides of the valley. The total rainfall for the three-weeks period was equal to more than a third of the annual average, over an area of many thousands of square miles.

Examination of the weather maps for the month of January, 1937, reveals the explanation for this long spell of rainy weather. The maps show that throughout most of the month high pressure areas persisted over the lower Atlantic coast and over the north central states. Between these two highs a low pressure trough stretched from Texas to Pennsylvania, thus allowing warm, moisture-laden air from the Gulf of Mexico to spred northeastward, where it came in contact with the colder high pressure atmosphere, thus causing the almost continuous precipitation. The twenty-day storm is estimated to have been fifty per cent greater than that of March, 1913, which resulted in the disastrous flood of that year.

Backwater flooding.—The flood map of southern Illinois shows an extensive area under water in Saline, Gallatin and White counties, covering the alluvial flats in the lower valleys of the Wabash, Saline and Little Wabash drainage systems. Inasmuch as the water flooded this region at elevations up to twenty feet higher than in the nearby Ohio Valley it must be immediately evident that this particular area was not inundated by water overflowing from the main river. The only possible explanation for this apparently anomalous situation is that the minor streams named above, having their outlets blocked by the flood in the Ohio, impounded their waters in their own valleys. These smaller streams, already swollen by excessive runoff, rapidly flooded the large areas of bottom land through which they normally flowed, while still maintaining a flow gradient of from two to six inches per mile. This situation was undoubtedly responsible for the plight of Harrisburg, Equality, Omaha, Texas City, and a number of other smaller towns, none of which would have been flooded directly by overflow from the Ohio. Measurements made on January 27, in the vicinity of Harrisburg, showed the water to be rising at the rate of ¾ of an inch per hour, indicating how quickly these ponded waters were accumulated.

Reoccupation of ancient Ohio Valley.—One of the most striking features of the flood in southern Illinois was the reoccupation of a

stretch of the Ohio Valley which has been abandoned for many thousands of years. This ancient valley was cut through the hills of Pope, Massac, Pulaski and Alexander counties, extending from a point about four and a half miles downstream from the present town of Golconda, in a westerly direction, to where it joined the Mississippi about eight miles northwest of Cairo. This old valley, generally referred to as "the Cache River Basin," is some fifty miles in length, and is from two to five miles in width, broadening to the westward in the direction of flow. It exhibits a slope of approximately five inches per mile along its floor, which throughout its extent maintains an elevation some forty feet higher than the normal water level elevation in the present valley of the Ohio, a few miles to the south.

Between the old and new valleys lies an isolated ridge of the Illinois Ozark Uplands, rising nearly three hundred feet above the lowlands that surround it, and varying in width from two to twelve miles.

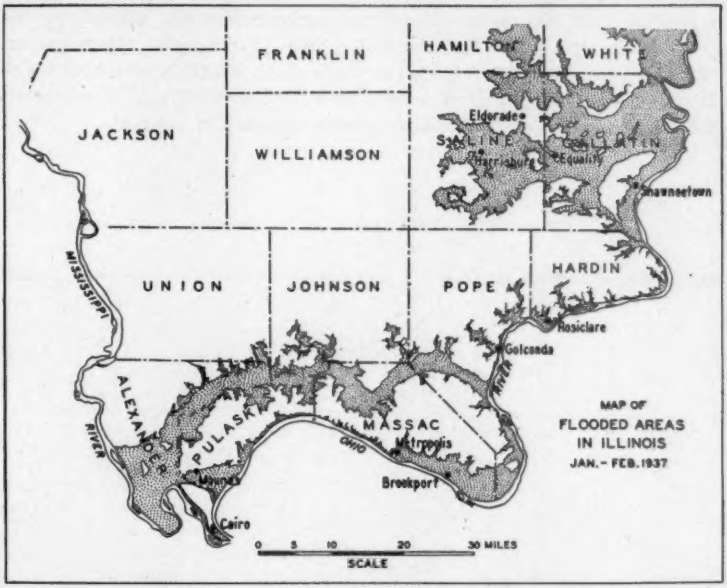
Although it is commonly known that the Cache River Basin was once a part of the main Ohio Valley, the details of its history are more or less obscure, inasmuch as no careful investigation has yet been made of the sequence of events involved in that history. The main facts are more or less evident, however, and can be supported by logic.

It is probable that the Ohio flowed through the old valley until some time near the close of the Great Ice Age (Pleistocene Time). With the melting of the ice sheets that had covered the Great Lakes region, tremendous quantities of water poured into the Ohio and Mississippi valleys, bringing about annual floods of amazing volume and duration, often filling the valleys entirely. With the waters overflowing the valley walls themselves, changes in stream configurations were inevitable.

Study of the topographic maps of southern Illinois suggests a plausible explanation of the situation which led to the abandonment of the old valley there. To begin with, we may assume that super-floods were probably coincident in both the Ohio and Mississippi valleys, near the close of the Great Ice Age. A Mississippi flood equal to or greater than one in the Ohio Valley would have caused a damming of the latter, with overflow into adjacent areas through low points in the valley walls, provided that a sufficiently high flood stage was attained. At the point near Golconda, where the old and new valleys branch apart, a narrow divide formerly existed between a right angle curve of the Ohio and what was probably a northward-trending valley tributary to the Cumberland River. During one of the glacial super-floods the Ohio waters undoubtedly overflowed at that locality, and in time lowered the divide below the elevation of the main valley at the curve. The Ohio thus took over the lower valleys of the Cumberland and Tennessee rivers, abandoning its former outlet to the Mississippi.

Since that time numerous floods have probably caused overflow waters from either the Mississippi or Ohio, or both, to reoccupy the old

valley trench; each flood depositing a layer of silt and silty clay on the old valley floor, gradually building up a considerable fill. In the meantime, erosion has deepened the present main valley to some extent, so that now there is a considerable difference in elevation between the two. The floor of the old valley, for instance, has an elevation of approximately 340 feet above sea level, at its upstream end. The present river flows past this point at an elevation of about 295 feet, making a difference of 45 feet. The recent flood, which attained a stage of a few inches less than sixty feet, thus caused the inundation of the old



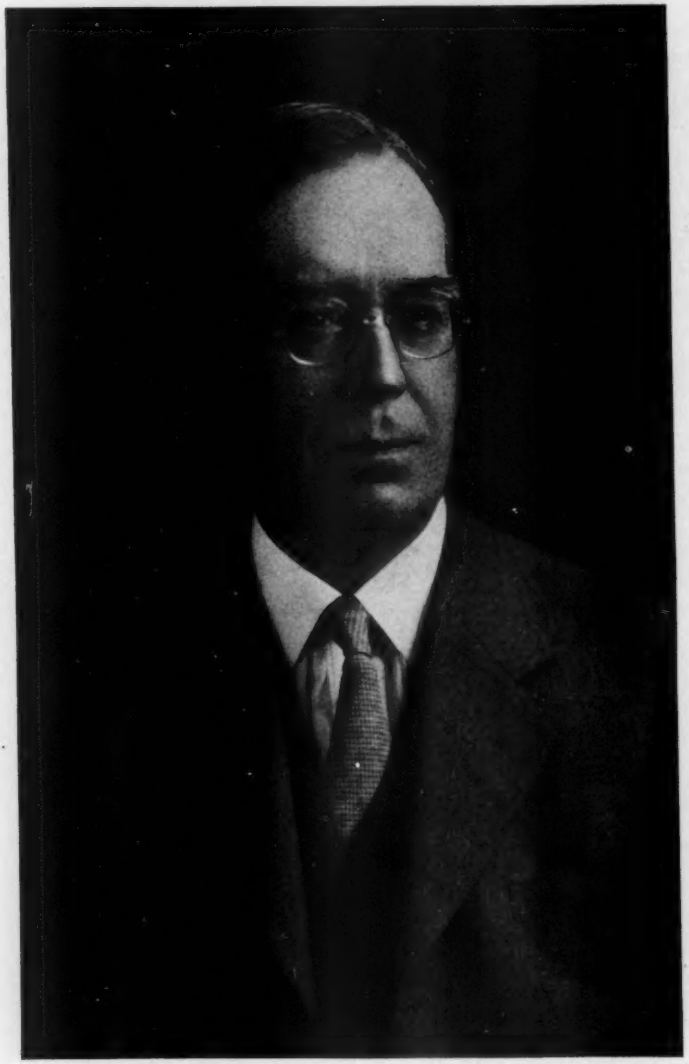
valley to depths up to fifteen feet, and even more, where erosion by the small streams now draining the old valley has lowered the general level of the flat. The accompanying map shows clearly how the ancient stream bed was reoccupied by the flood waters of 1937.

A number of towns are located within the old valley trench, namely: Tansill, Brownfield, Reevesville, McNoel, Mermet, Belknap, Karnak, Perks, Ullin, Pulaski, Tamms, Sandusky, Unity, and Olive Branch. All of these towns were flooded, either wholly or to a considerable extent, in addition to the many farms located along the Cache River Basin. The resulting distress constituted a real disaster; but if the flood waters had not been allowed to occupy this basin (that is, if levees had been built to close off the valley entrance) the flood crest

would certainly have been considerably higher in the present valley, and in the towns and cities situated on its banks. Metropolis, Paducah and Smithland, for instance, would have been in a much more serious plight and it is probable that the city of Cairo would have been completely wiped out. This is a point to be considered in planning future flood control measures for the region under discussion.

It is evident that the plan of the flood control project begun in 1928, and virtually completed at the time of the 1937 flood, will need to be revamped to some extent. The project was carried through on the assumption that no flood would exceed a theoretical "super flood" having a flow of 2,400,000 second feet at the confluence of the Mississippi and Ohio rivers, at Cairo. It is estimated that approximately that amount of water was discharged from the Ohio alone during the recent flood. If the Mississippi had likewise been in a flooded condition, the theoretical "super flood" would have been greatly exceeded in actuality.

MEMOIRS



EDWIN OAKES JORDAN

EDWIN OAKES JORDAN

1866–1936

Edwin Oakes Jordan, whose death on September 2, 1936 removed a distinguished member of the early generation of American bacteriologists, was born in Thomaston, Maine, on July 28, 1866, the son of J. L. and E. D. (Bugbee) Jordan. On June 16, 1893 he married Elsie Fay Pratt, who survives him with their three children, Henry Donaldson, Edwin Pratt and Lucia Elisabeth Dunham.

Dr. Jordan took his bachelor's degree at the Massachusetts Institute of Technology in 1888. His teacher there, William T. Sedgwick, had a profound influence upon the direction of his career and interests toward public health work. After working with Sedgwick from 1888 to 1890 on the staff of the Massachusetts State Board of Health during the period of Sedgwick's famous work on sanitary bacteriology, Dr. Jordan worked as a fellow under Charles O. Whitman at Clark University, where he was given the degree of Doctor of Philosophy in 1892. The honorary degree of Doctor of Science was given him at Cincinnati in 1920.

In 1892 Dr. Jordan joined the faculty of the newly formed University of Chicago as Associate in Anatomy, becoming Instructor the following year. In 1895 he became Assistant Professor of Bacteriology, and later Associate Professor, Professor and Chairman of the Department of Bacteriology. He continued in this capacity until 1933 when he retired from administrative work of the department with the title of Andrew MacLeish Distinguished Service Professor Emeritus of Bacteriology.

Dr. Jordan had that unusual vision which is the mark of the distinguished scientist, the ability to correlate his scientific discoveries with a perception of their trend and significance and their possibilities of practical application. This explains much of the breadth of interest of his publications. From water purification, sewage disposal, pasteurization of milk and the bacteriology of typhoid fever, all the outcome of his association with Sedgwick, he proceeded to work on influenza, intestinal bacteria, paratyphoid bacilli and food poisoning and bacterial variation. To the last his mind was continually busy with future experiments and papers which he was planning. His knowledge of the literature was an important factor in the value of his work as he was able to give almost exact references without consulting files and had on occasion gone directly to an insignificant but decisive article to clear up a point for a colleague in that colleague's particular field.

His writings were extensive, numbering 176 separate publications, among them his books on Epidemic Influenza, Food Poisoning and Food-Borne Infection, and his General Bacteriology, which is in its eleventh edition. Aside from its scientific value his writing merits high rating for its precision of expression, as he took the utmost pains in revision to insure clarity, exactness and style. He was joint editor of the Journal of Infectious Diseases, editor of the Journal of Preventive Medicine during its existence and then editor of the epidemiological section of the American Journal of Hygiene.

A great deal of Dr. Jordan's time and strength was given to activities and administration of scientific organizations. He was interested in local public health problems and presented valuable testimony for the Sanitary District of Chicago during the controversy over the pollution of the Illinois River by the Chicago drainage canal. He served as trustee of the John

McCormick Institute for Infectious Diseases, president of the Chicago Pathological Society in 1906 and of the Institute of Medicine of Chicago in 1932, He was a life member of the Illinois State Academy of Science and was a member of the Chicago Board of Health up to within a year of his death. He was one of the founders of the Society of American Bacteriologists and the Epidemiological Society. He was a member of the American Public Health Association, which awarded him the Sedgwick Memorial Medal, an honor which he particularly appreciated because of his association with Sedgwick. The Medical Fellowship Board of the National Research Council, the International Health Board of the Rockefeller Foundation and the Board of Scientific Directors of the International Health Division, and the Council on Foods of the American Medical Association, on which he was specialist on food poisoning, are among the many organizations to which he gave valuable service.

The final honor of Dr. Jordan's career was his election to the National Academy of Sciences, which came just before his last illness and was a source of cheer to him during that time. With his death science has lost a distinguished thinker and his associates have lost a friend who, unknown to them for the most part, was constantly trying to open to them better opportunities.

S. A. Koser

EDITH MURIEL POGGI

1886–1937

Edith Muriel Poggi was born in Liverpool, England, in October, 1886 of English-Italian parentage. Her father was a friend of the famous Italian liberator, Garibaldi.

Much of her education, as well as her early teaching experience was obtained in English schools. She graduated from The Teacher's Training College, Liverpool in 1905, and received the University of London Academic Diploma in Geography in 1921, with mark of Distinction for Thesis presented. This was followed by two years of graduate work at the London School of Economics; University College, London University, and at the University of Oxford.

Busy as these years were she found time for extended study in Switzerland, Italy, Belgium and France. Here her knowledge of history, art and geography, as well as familiarity with the languages, enabled her to supplement her college training with an intimate first hand understanding of western European peoples and their problems.

During the World War she was associated with the British War Office as cartographer, doing detailed mapping of the Verdun Sector.

For ten years, 1914-1924, she was in charge of the Geography Department of the Camden School, London, coming to California in September of the latter year. Here at Pasadena, she taught part time, in the Westridge Preparatory School, gave public lectures and travelled extensively in both the United States and Canada.

Coming to Illinois as part-time assistant in Geography in 1926, she took her M.A. there in 1928; her Ph.D. in 1930.

She was an active member of The National Council of Geography Teachers, the Royal Geographical Society, Sigma Xi, and the Illinois State Academy of Science. The number and variety of her contributions attests her interests. Some of them are listed below:

"The Red Land of Gwent in Eastern Monmouthshire." *Economic Geography.* Vol. 4. No. 1. January 1928.

"Coal Mining Methods in Illinois." *Geography.* Vol. 14. Summer No. 1928.

"The Mineral Deposits of Upper Silesia." *American Geographical Review.* Vol. 18. No. 2. April 1928.

"A Brief Outline of the British Woolen Industry." *Journal of Home Economics.* Vol. 20. No. 11. November 1928.

"The German Sugar Beet Industry." *Economic Geography.* Vol. 6. No. 1. January 1930.

"The Forest of Dean Coalfield in Gloucestershire." *Economic Geography.* Vol. 6. No. 3. July 1930.

"Devonshire: A Study in Rural Geography." *Bulletin of the Philadelphia Geographical Society.* Vol. 28. No. 23. July 1930.

"Mineral Raw Materials," published by U.S.D.C. A Review. *American Geographical Review.* Vol. 20. No. 2. April 1930.

"The Geographic Regions of Illinois." *University of Illinois Bulletin.* Vol. 28. No. 16. December 1930. High School Conference Issue.

"Settlement and Development of the Prairie Province of Illinois." 1931.

"Prairie Province of Illinois. A Study of Human Adjustment of the Natural Environment." 1933.

"Decatur, Illinois. Study in Urban Geography." 1934.

Always a tireless worker, she contributed all too generously of her time and strength to her teaching and research. Her body, always frail, began to show signs of giving way under the strain and her later years were marred by long periods of hospitalization. Few knew of her intense sufferings for she always maintained a cheerful optimism. Death brought relief to her suffering April 13, 1937, at a Sanitarium in New Jersey where she had spent much of the last year.

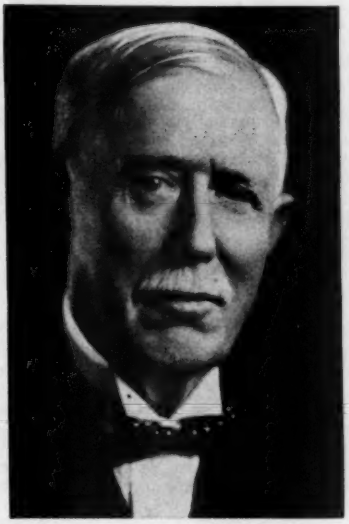
A born teacher, she loved her work, and her energy and enthusiasm were contagious. She possessed to an extraordinary degree the rare gift of making and keeping friends. A better example of the triumph of the spirit over the flesh would be difficult to find. Her best monument is in being remembered vividly by a host of friends who were privileged to enjoy her comradeship.

W. O. BLANCHARD

FRED R. JELLIFF

PRESIDENT OF THE ILLINOIS STATE ACADEMY OF SCIENCE, 1931

1854–1936



Frederick Reuben Jelliff, one of the best known newspaper editors of the middle-west, died in his home city after a brief illness September 17, 1936. He was born in Whitesboro, New York, September 25, 1854. He is survived by his wife, Lillie C. Bassler Jelliff.

Mr. Jelliff was of sterling Christian character, a gentleman and a loyal citizen of his city, state and country. He was endowed with many talents all of which were developed and used effectively in the program of his life service.

Fred Jelliff as a young man left the state of New York and The Whitesboro community which had been the home site of the original founders of the Galesburg colony and came to live in the stimulating atmosphere of those sturdy pioneers. In that new prairie community he attended school and college. Mr. Jelliff was the Valedictorian of the class of 1878 of Knox College. After graduation he became a teacher in the Galesburg High School for three years and then he entered the field of journalism. Although journalism claimed fifty-five years of his life Mr. Jelliff never ceased being an excellent teacher, exemplary, as well as an active leader.

In 1881 he joined the staff of the Galesburg Republican-Register serving first as reporter, then as city editor, and later as editor, a position which

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he held at the time of his death. His able editorship, sincerity of purpose and clear thinking combined with abundant service stand as a lasting tribute to his life.

Mr. Jelliff loved to write. His pen contributed to many departments of his paper. He wrote on many subjects dealing with exploration, geology, industry, stream pollution, botany, conservation, history, and comments on the topics of the day. He was an authority on certain phases of economic geology.

All through life he was a lover and student of Nature. His vacation periods, the week-ends, were not merely rest periods; on the contrary these intermissions served as opportunities to broaden his experience and to expand his knowledge of Nature. Week-ends in fair weather found Mr. Jelliff in the "strip pits" or in the region of the mines searching for specimens of significant geologic interest. He made occasional trips to observe the latest improvement in public water supply or to learn of the most recent method of sewage treatment. He frequently spoke of these afternoon trips as "geologizing expeditions". He was familiar with all of the coal-bearing strata of the Illinois coal fields. Mr. Jelliff not only energetically pursued geology as a hobby, but for a time served as special lecturer in Geology at Knox College. His specimens have supplemented many museum collections, and the Hurd Museum of Knox College has been enlarged through numerous gifts of his fossil and other geologic material.

Mr. Jelliff was a charter member of the Illinois State Academy of Science and from its beginning was a loyal and energetic supporter of its objectives. He served as its president in 1931; he was active in the work of many of its committees; he read many papers before its sessions; he contributed many articles to its journal. In addition to his work in the State Academy of Science Mr. Jelliff found time for activity in many local organizations. He was one of the founders of the Knox County Academy of Science. Mr. Jelliff was also an honorary member of the Peoria Academy of Science.

His service reached beyond his home community. For many years Mr. Jelliff was a member of the board of trustees of the Western Illinois State Teachers College. His energies found expression in many civic and humanitarian enterprises over the state.

Mr. Jelliff had no time for the trivialities or unworthy pleasures, he had no expensive habits. He lived a simple life. He was a liberal giver, not only in the material things, but in the spiritual as well. His true worth was shown in his wide tolerance for the opinions and beliefs of others. His charming personality, gentle voice, kindly smile, and friendly greeting can not be recorded in the printed word.

CLARENCE LEE FURROW